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ABSTRACT

Additional training needs desired by the electrical skilled personnel of the metal casting industry were the focus of a study. A questionnaire was distributed to electricians and electrical engineers employed in 39 foundries in over 20 states. Of the 150 surveys, 63 responded for a 42 percent return. The questionnaire was divided into three sections: education, plant information, and marketing information. Education and training needs were identified by answering three questions: What are the present strengths and weaknesses of the metal casting industry? What are the rank-ordered training needs for the electrical skilled workers? and What type of training sessions would be of most value to the electrical maintenance departments? Findings were as follows: (1) educational level was an important work force strength; (2) perceived lack of training budget was an industry weakness; (3) most needed training topics are induction melting, power SCRs, programmable controllers, hydraulic circuits, and poser circuits; and (4) short courses with hands-on experiments was the most favored training method. (A bibliography contains seven items and eight additional works are cited. The survey, seven endnotes, four graphs, and eight tables are included.) (NLA)

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A Survey of the Training Needs
for the Metal Casting Industry's
Electrical Skilled Trades

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EDU 545

Research Paper

August 1991

ABSTRACT

A Survey of the Training Needs for the Metal Casting Industry's Electrical Skilled Trades

by

Mary Ann Hall

The study was undertaken to determine what additional training needs were desired by the electrical skilled personnel of the metal casting industry. A questionnaire was formulated and distributed to electricians and electrical engineers employed in thirty-nine foundries in over twenty states.

The results were analyzed and conclusions formed. The study shows the strengths and weaknesses of the foundry personnel; indicates the training needs; and reveals the type of training desired.

The conclusions were formulated based upon this data and are presented in the following research study.

Table of Contents

List of Tables.	iv
List of Graphs.	v
Chapter	
1. Introduction	1
Statement of Research Problem.	2
Literature Review.	2
2. Background of Study.	5
Subjects	5
Procedures	7
Instrumentation.	8
3. Analysis of Data	10
Research Question One.	10
Research Question Two.	18
Research Question Three.	20
4. Conclusions and Interpretations.	25
Endnotes	30
Bibliography	31
Works Cited.	32
Appendix	33

LIST OF TABLES

Table

1. Plant Characteristics.	5
2. Respondents Characteristics.	6
3. Why More Training Is Necessary	13
4. Plant Size	16
5. Rank Order of Topics by Mean Score	19
6. Rank Order of Preferred Training Methods.	22
7. Rank Order of Training Months Preferred.	23
8. Preferred Training Schedules	24

LIST OF GRAPHS

Graph

1. Rank Order of Perceived Reasons Why
More Training Is Not Provided 11
2. Perception of Management's Under-
standing of Training Needs 12
3. Influence On Decision. 17
4. Mean Scores of Twenty-two Topics 21

Chapter 1

INTRODUCTION

The metal casting or "foundry" industry is that industry which makes unfinished parts from molten iron, steel, aluminum, and brass stocks. These castings are then purchased by customers for final finishing.

Metal casting is a labor intensive part of manufacturing. Even though the industry has applied some high technology, automated processes, and robotics, the manufacturing process still remains labor intensive making it presently uncompetitive with foreign sources. Metal casting buyers are now seeking sources outside of the United States to reduce their costs.¹ The casting industry in the United States must continue to implement high technology in the manufacturing process to maintain market share. To reverse this trend, U.S. metal casting plants must continue to automate their processes and better maintain the equipment they now have. Future additions in their manufacturing process will require additional maintenance skills to optimize productivity. These improvements will require workers with the skills to maintain such equipment. "The key to competitiveness is an educated, well-trained work force."²

Statement of Research Problem

The purpose of the study is to investigate the educational and training needs of the skilled tradesmen in the electrical maintenance department of the metal casting industry. This research paper investigates what education or training is needed by answering the following questions:

1. What are the present strengths and weaknesses of the work force currently employed in the electrical maintenance departments of the metal casting industry?
2. What are the rank ordered training needs for the electrical skilled tradesmen?
3. What type of training sessions would be of most value to the electrical maintenance departments?

Review of Literature

A review of primary and secondary literature was conducted to determine if other studies have been done in this field. The first source used was the Educational Resources Information Center (ERIC), an informational database. In order to use the computerized database, a

list of descriptors was formulated. The following combination of descriptors was used in the search:

1. Vocational Education
2. Training
3. Industry
4. Manufacturing
5. Electrical
6. Maintenance
7. Electricians
8. Foundry
9. Iron
10. Steel
11. On-Job-Training
12. In-Plant

No information was found when the descriptor "electrical" was added in combination with the other descriptors. Therefore, no past studies have presented research in this area, perhaps because of its narrow scope.

Some studies have been done on the educational needs for the manufacturing sector, but they do not focus on the narrow field of electrical skills. The topics of some of these articles are listed below:

1. Industry Based Training (Stone 1989)
2. Auto Suppliers and Higher Technological Training Needs (Jacobs 1986)
3. Effects of Training and Productivity (Medoff 1982)

Industry trade journals and newspapers were another source selected for review. Again the information was general, not specific for this particular group of electrical skilled trades. Again, it appears that the education and training needs for this group of people

have not been investigated. The foundry trade magazines lead one to believe that training is truly needed, but no specifics have been reported on what the needs are.

Some subjects published are listed below:

1. Better Students and U.S. Competition (Modern Casting, June 1991)
2. Cast Industry and Education (Modern Casting, June 1991)
3. General Motors and Mexico (Saginaw News, July 1991)
4. Upgrading of Skills (Modern Casting, July 1991)
5. Employment Market for Electrical Engineers (National Business Employment Weekly, July 7, 1991)

This investigation is designed to answer the training needs question for the electrical skills trade. The literature search did not reveal any previous studies in the area of this investigation. Much new research could concentrate on this area because it is a wide-open, unexplored field.

Chapter 2

BACKGROUND OF STUDY

Subjects

The survey questionnaire was distributed to 150 electrical skills people in the metal casting manufacturing industry. Of these 150 surveys, 63 responded for a 42% return from 39 different companies.

The respondents returning the survey were from small, medium and large metal casting plants with the majority from medium size foundries. In addition, the largest segment of the sample was from the cast iron foundries with the copper and brass segment having the least representation. (See Table 1)

TABLE 1

Plant Characteristics
Total of 38 plants Surveyed

Metal Type*	Number of Responses
Cast Iron	47
Steel and Steel Alloys	21
Aluminum	10
Copper and Brass	2

*Note: Respondents may have more than one type of metal to melt.

The subjects varied by length of employment, level of education, and job classifications. (See Table 2)

TABLE 2
Respondents Characteristics

Job Titles			
Job Class.	Number of Responses from survey (possible 63)	Total Number of Employees in plant with classification	Avg./all plants
Electricians	59	541	9.16
Supervisors of Electricians	56	141	2.51
Electronic Tech.	29	42	1.45
Electrical Engrs.	25	37	1.48

Education		
Last Level of Education Completed	No. of Responses	%
11th grade or less/12th grade or GED	24	38
one/two years of college	20	32
three/four years of college	12	19
more than four years of college	7	11
	n = 63	100

Employment		
Length of Time with Employer (Rounded to Whole Numbers)	No. of Responses	Avg. Length Yrs
One to Five Years	25	2.80
Five to Ten Years	9	7.10
Eleven to Fifteen Years	10	11.80
Over 15 Years	15	18.73
	n = 59	

The sampling showed that 38 percent of the respondents have a high school education or less with only 29 percent having from three or more years of college.

The survey had four job title classifications:

- Electricians
- Electrical Technician
- Engineers
- Supervisors

The survey participants were made up of approximately half classified as hourly workers and the other half classified as salaried employees.

Procedures

The questionnaires were mailed to people which were on a list compiled by Automation Controls, Inc. (ACI). This list consisted primarily of electrical people who obtained training from ACI within the last three years. In addition, questionnaires were passed out during in-plant visits. To eliminate experimenter bias or contamination when the questionnaire was handed out, the respondents were simply asked to fill out the questionnaire with an explanation that the research was to be used only by ACI. One key reason for the high response rate was the inclusion of a hand-written letter with the questionnaire. The letter requested their cooperation in responding.

In an effort to maintain external validity, the questionnaires were asked to be mailed back directly to

the researcher. If this was not possible, the questionnaires were collected en masse so the Hawthorne effect would not invalidate the findings.

This study may not be considered scientific because the population was restricted to the ACI list. But even with this selectivity, there is no evidence that this is not representative of the industry. A list of the territories represented are as follows:

Arizona	Ohio
California	Oklahoma
Colorado	Pennsylvania
Indiana	South Carolina
Kansas	Tennessee
Kentucky	Texas
Massachusetts	Wisconsin
Michigan	Ontario, Canada
New Jersey	Gloucestershire, England
North Carolina	

The data collected will be interpreted with the use of correlation coefficients, rank order, means, percentages, and graphs.

Instrumentation

The questionnaire was developed as a closed-ended checklist. However, six of the twenty-seven questions were open-ended. The questionnaire was divided into three sections:

Section I: Education
 Section II: Plant Information
 Section III: Marketing Information

Before distribution, the questionnaire was field tested by two different groups in Big Rapids, Michigan at ACI training seminars. No major changes had to be

Hall 9

made in the questionnaire as a result of the field
testing. (See Appendix for Questionnaire)

Chapter 4

Analysis of Data

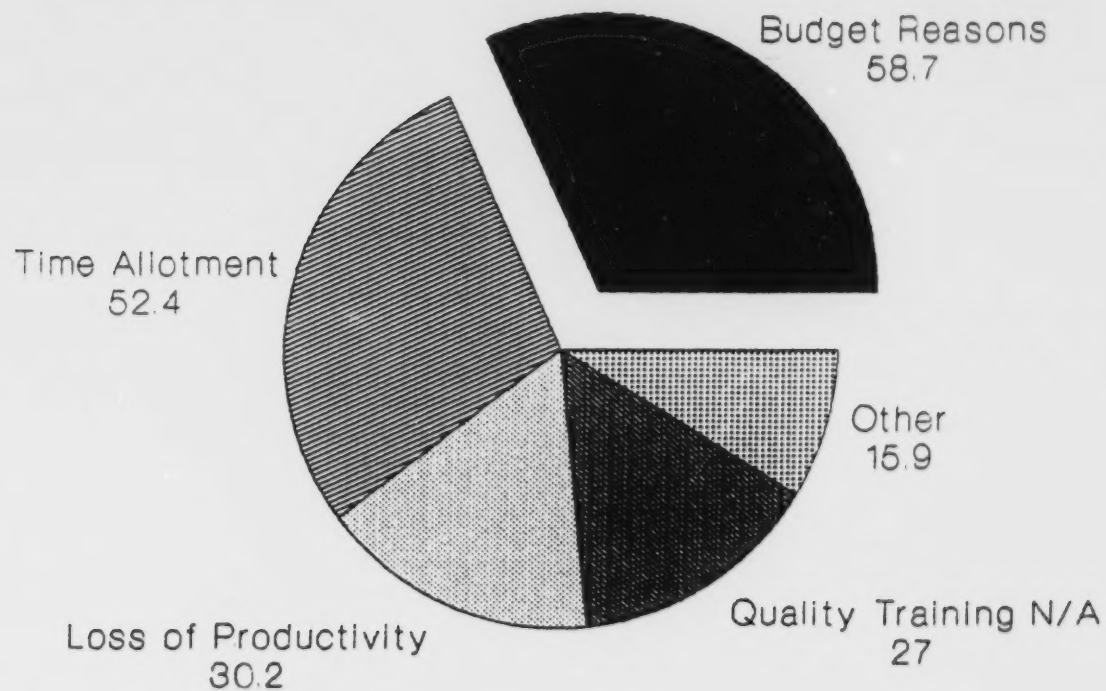
The findings from the data collected are listed below as related by the research question in the problem statement.

Research Question One

The research paper's first question looks at the present strengths and weaknesses of the work force. The data collected showed that the 59 percent of the respondents from the survey believe budget is the number one reason why more training is not given. The second highest reason was time allotment. (See Graph 1)

But when questioned about if there was an increase in training during the last five years at their plant, 71 percent said yes. Out of forty-nine responses, 27 percent reported training for the electrical people about twice a year. Forty-one percent reported having one training session more than two years apart. According to the survey, the respondents' believe management does see a need for more training, but seems unable to provide it. (See Graph 2)

Perceived Reasons Why More Training is Not Provided



By Percentages

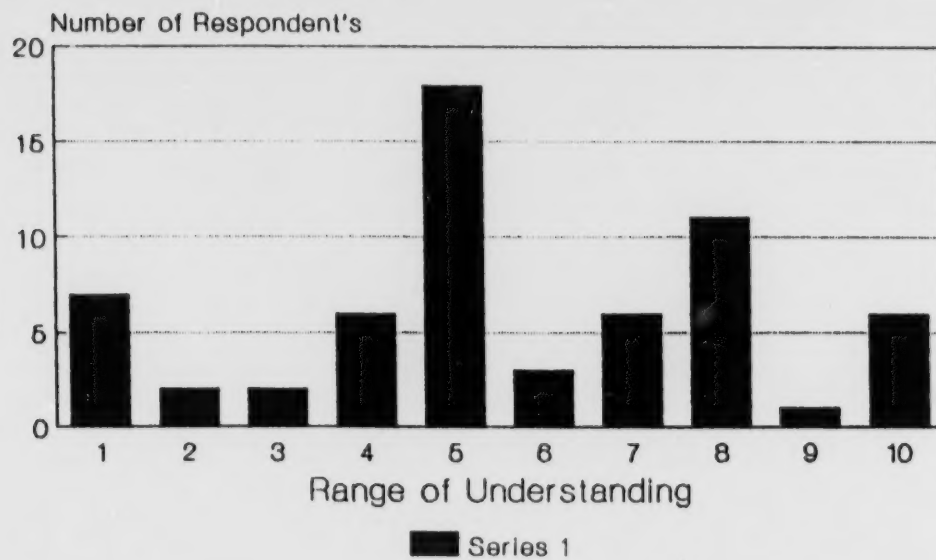
Graph 1

17

Hall 11

18

Perception of Management's Understanding of Training Needs



Graph 2

When asked if there was a budget set aside for training, 73 percent of the respondents answered no or did not know. Only 27 percent of the responses knew of a training budget. In every article reviewed not one author mentioned how more training was to be provided financially. This may be a real problem for the industry.

Table 3
Why More Training Is Necessary

Reason	No. of Respondents	%
New Equipment and Technology	54	86
Machines More Complicated	51	81
Need Refresher Course	39	62
No Formal Electrical Training	20	32

(Please note that these percentages do not total 100 percent because respondents could check more than one answer.)

The question was asked of the respondents concerning why training may be necessary in their plant? New equipment and technology brought into the plants was the main reason expressed for the need of more training with 86 percent of the surveys checking this statement. The knowledge that the machines have become more complicated and require more technical knowledge to repair was the second reason checked for more training (82%). The need

for a refresher course was expressed by almost two-thirds of the work force (62%) with 32 percent saying that the electricians do not have formal electrical training and need basic electrical concepts. (See Table 3, page 13) What is implied from these results are an increase in the desire and need for more training.³

Another possible weakness in the work force that was investigated is the education level. The education level of the respondents showed that 38 percent of the group had a twelfth grade education or less. One to four years of college was obtained by 32 percent of the group. (See Table 2, page 6.) One of the strengths of the work force based upon Question #24 of the survey is that the vast majority understand basic electrical principles and only need additional skills in advance topics. This means a minimum of remedial work is necessary. (See Table 5, p.19)

Another aspect of the educational level was evaluated concerning education and age of workers. A hypothesis was developed asking if the level of education was higher among younger employees. Data collected assumed that the longer a person was employed with the firm, the older the worker was. A Pearson rho correlation coefficient was developed using the level of education stated and the number of years employed by the firm to test the relationship. A moderate, negative

relationship occurred with the $r = -0.313978$. The results may suggest that younger workers do have slightly more formal education than older workers. In the past many workers in this industry learned on-the-job. A formal education was not needed to be employed. The data supports the belief that much training of many types of further education is needed to enable the worker to understand the new technology. New equipment and processes in the manufacturing sector will demand advanced skills in the future.

The relationship between the size of plant and the availability of a training coordinator was analyzed. A Pearson product-moment correlation coefficient was developed to measure the relationship. The one of the two measures used for analysis came from the data collected from Question #3 of the survey, "How many total employees are in your plant?" The possible answers of the number of employees were from 1-100 (small), 100-600 (medium), and 600-over 1200 (large). (See Table 4) Sixty-two percent of the respondents were from medium size plants with nineteen percent each from the small and large plants. The second measure used was from Question #4 of the survey, "Do you have a training coordinator at your facility?" Three choices were available for a response, "yes", "no", and "not sure".

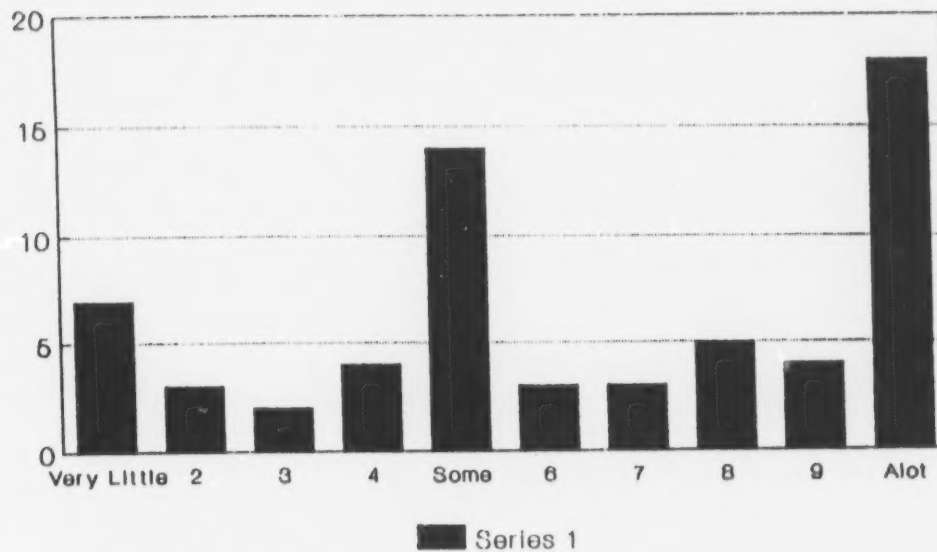
Table 4
Plant Size

Number From Each Size	Size of Plant
12	1 - 100
39	100 - 600
12	600 - over 1200
n = 63	

The hypothesis proposed that a statistically significant difference would be seen in the size of plant and whether a training coordinator was employed. The result of the statistical analysis showed a negative relationship of the Pearson $r = -.080509$. Therefore, the null is rejected as having no marginally significant difference. A research study completed in 1986 also came to the same conclusion. The size of the plant did not matter if a training coordinator was employed or not.⁴

From a marketing aspect the data collected was analyzed to determine the best method to reach the respondents when a training class was available. The data revealed that getting information from their supervisor was the best method. Ranking second and third respectively was from equipment manufacturers and through trade magazines/papers. When the respondents were asked how much influence they had on their decision to attend, 75% checked from some to alot. (See Graph 3)

Your Influence on Decision For More Training



Graph 3

Next the information was analyzed to see if job classification made a difference when information was received through trade magazines/papers. The findings showed that 81.5 percent of the respondents that checked getting information this way were salaried people, i.e. engineers and supervisors.

Research Question Two

This question asks what are the rank ordered training needs for the electrical skilled tradesman. A training need exists when there is a frequency of job tasks which an employee is not proficient enough to perform productively.⁵ Training needs will be evaluated by topic areas in this study. Topic areas were selected after consultation with an expert in the field.

When given a list of twenty-two topics, 59% wanted more Electric Principles for Induction Melting. Table 5 ranks topics by the mean score.

TABLE 5

Rank Order of Topics by Mean Score

Topics	Mean Score
Induction melting---Electric principles	3.903
Power SCR's	3.838
Programmable controllers	3.725
Hydraulic circuits	3.387
Power circuits (real reactive, apparent, power factor)	3.370
Transformers---potential and current	3.338
How to operate and use an oscilloscope	3.290
Digital electronics	3.258
AC motors	3.225
Magnetic fields and circuits	3.209
Electrical amplifiers	3.112
Motor starter circuits	3.048
Microprocessor construction and programming	3.032
Pneumatic circuits	3.016
Basic computer programming	3.016
National Electric Code	2.903
AC circuits series and parallel	2.806
Basic ladder diagram reading	2.741
DC motors	2.693
DC circuits and series and parallel	2.661
AC generators	2.258
DC generators	2.193

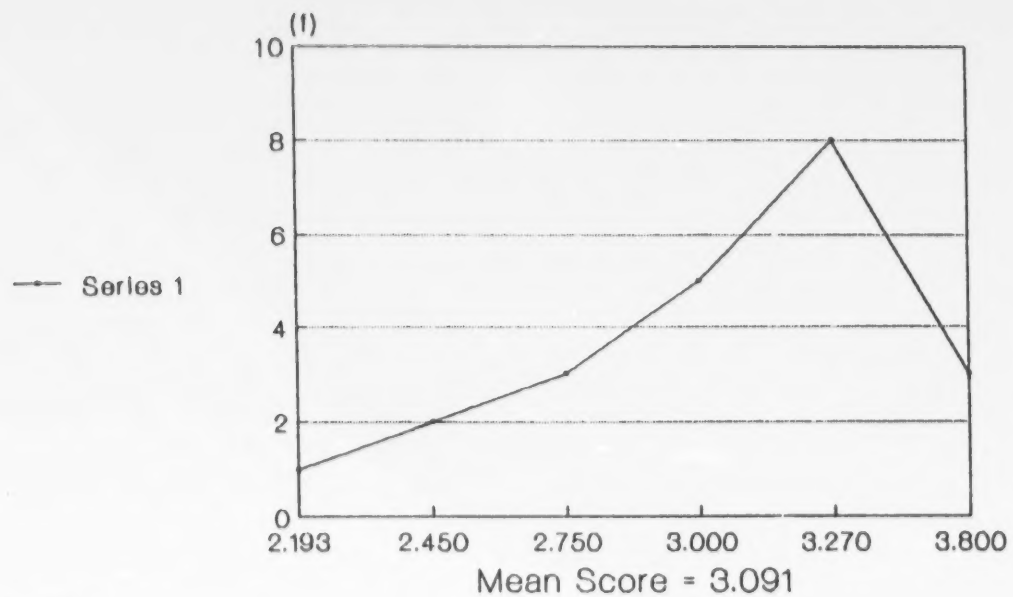
NOTE: Multiple responses allowed
Topics ranked (5) for NEEDED to (1) for NOT
NEEDED.

When analyzing the mean scores, the results are positively skewed. (See Graph 4) The expected mean in a range of 1 - 5, would be 3. The data collected has a mean of 3.091 with a standard deviation of .43. What is implied from these results are an increase in the desire for more training. Again this supports a study by Stone that employers are finding it difficult to hire workers with the needed skills. Therefore, they must train new hires or retrain their established work force.* For the workers to stay current they must constantly be upgrading their skill levels.

Research Question Three

The last question of the research problem asks what type of training session would be of the most value. Since many teaching and training methods are available in the marketplace today an evaluation of time of year, teaching methods, and daily times preferred was performed. From the data collected in this research a definite preference evolved in methods. (See Table 6) The most favored teaching method was to attend short lectures with hands-on experiments with the use of appropriate equipment. The least favored method was to read material and mail in tests.

Mean Score of Twenty-two Topics



Graph 4

TABLE 6

Rank Order of Preferred Training Methods

Method	Mean Score
Attend short lectures with hands-on experiments with use of appropriate equipment	4.476
Lecture followed by inspections of equipment at your plant	3.810
Attend lectures with practical problems	3.716
Attend lectures	2.800
Read material and mail-in tests	2.050

NOTE: Methods ranked from (5) MOST to (1) LEAST preferred.

For many years very few plants in this industry have had no training coordinators. It is encouraging to find that 57 percent of the respondents say they now have a training coordinator in their plants.

The data was analyzed to determine if there was an opinion as to what is the best time slot for them and management. Time allotment was ranked the second highest reason why more training was not available. When asked to rank the best months for training in your department, January/February was the top selection. (See Table 7)

TABLE 7

Rank Order of Training Months Preferred

Month	No. of Responses	Mean Score
January/February	53	2.452
March/April	49	2.530
September/October	49	3.265
November/December	48	3.750
May/June	49	3.775
July/August	49	4.653

NOTE: Rank was for #1 being the best time to #6 the least favored time.

Then looking at the data and rating the most preferred training schedule, the workers selected 1/2 day session in-plant for "X" number of days. Longer sessions were clearly not preferred and neither were a few hours before or after work. (See Table 8) The desire by employees not to put in extra time to gain knowledge is a definite weakness here.

Whereas, their belief of management's desire for training schedule showed that a few hours before or after work was preferred. This selection of an answer shows that there is little belief that management has a strong commitment to further training or education of the work force. (See Graph 1, p. 11) This finding agrees with what Robert Reesman, vice-president of Intermet Foundries stated in his speech at an American Foundrymen's Society conference, "That workers feel alienated from their leadership."

Table 8

Preferred Training Schedule

By Respondents

Time of Session	Mean Score
1/2 day session in-plant for "X" number of days	4.192
8 hour session off-site	4.017
8 hour session in-plant	3.016
A few hours before or after work	1.046

Perceived Training Schedule
Preferred by Management

Time of Session	Mean Score
A few hours before or after work	3.607
1/2 day session in-plant for "X" number of days	3.352
8 hour session in-plant	3.230
8 hour session off-site	2.775

NOTE: Ranking was from #5 most to #1 least preferred.

Chapter 4

Conclusions and Interpretations

Restatement of Research Problem

The purpose of the study is to investigate the educational and training needs of the skilled tradesmen in the electrical maintenance department of the metal casting industry. The metal casting industry in the United States is on a decline. The need for greater productivity with the use of more complex equipment or retraining to maintain employment is critical in today's manufacturing industry.

Restatement of Methodology

A survey questionnaire was distributed to 150 electrical skills trades people in the metal casting industry. Of these 150 questionnaires, 63 were returned. Descriptive quantitative data was used for the findings. Relationships were explored with correlation coefficients.

Main Findings

The main findings from the data collected are as follows:

Research Question 1.

One important strength of the work force found in the survey was the educational level. Sixty-two percent had some college level education.

A major weakness of the industry is that only 27 percent of those surveyed believed their company had a budget set aside for training.

Research Question 2.

The survey revealed the following as the five most needed training topics:

1. Induction melting --- Electrical Principles
2. Power SCR's
3. Programmable Controllers
4. Hydraulic Circuits
5. Power Circuits (Real Reactive, Apparent, Power Factor)

Research Question 3.

The most favored training method selected was to attend short lectures with hands-on experiments and use of appropriate equipment. The least favored method was the independent study method, read and test.

Conclusions

Several conclusions can be derived from the findings. They are listed as follows:

Research Question 1.

The educational level of most of the respondents show they need only minimal skills to advance in their field. Only a very few need remedial work.

Basic skills education/training is not needed for the majority of these people. Specialized or customized training would be the most appropriate. Training should be structured on advanced topics with a quick review of the basics as a refresher.

Research Question 2.

Enough interest has been found for these top five topics that development should be started on these topics. These subjects can be considered "advanced" in their field.

Research Question 3.

Research Question 3 asks what type of training sessions would be of most value to the electrical maintenance departments. Once conclusion is that training should be designed as in-plant to reduce costs and time needed. The first months of the year would be the best time to schedule any type of training. When these topics are developed they should be developed with hands-on experiments.

Methodological Limitations

One limitation discovered in this research paper was the small sampling. If a larger sampling would have been gathered, a relationship between respondents and type of metal casted could have been analyzed. As is was, too little data was available to conduct such and analysis.

Field Applications

The information gathered in this investigation is intended to be used as a guideline for the development of future classes. Private consultants and training coordinators may not be aware of what this specific population needs to attain greater productivity in their area.

The paper is also intended to make the foundry industry aware of the training needs for this particular segment of the work force. This research will point out future education and training needs to those in command of the U.S. foundries. These are the people that can make the changes for the future of the industry.

To sell the training, the marketing company should contact the training coordinator since more than half the companies now employ a training coordinator. One recommendation for marketing the classes would be to advertise them by providing notices on bulletin boards and through union newspapers. Currently the majority of the information is received only from upper levels of management.

The training development should be done now because the new technology will force the commitment to training. Another reason is that many companies do have training budgets.

Recommendations for Future Study

An investigation is recommended to determine the training needs of other skilled groups such as machinists, millwrights, pipefitters, etc. This additional investigation could result in the formulation of new training classes which could be very marketable in the manufacturing industries.

The following questions have arisen that could merit further study. They are as follows:

1. Are there any relationships between type of metal casted and educational level of the electrical skilled trades?
2. Are there any relationships between the electrical skilled trades and other skilled trades?

ENDNOTES

¹ Ruth Fedrau and Kevin Balfe, "The Impact of Technology on Work: The Factory of the Future is Here Now." Journal of Career Development, vol. 12, no.4 (June 1986): 286.

² "Help the Eagles Fly." Modern Casting, June 1991, 41.

³ Laura Selleck, The Labor Market Impacts of High Technology: Implications for the Universities. ERIC, 1983. ED238328.

⁴ James Jacobs, The Training Needs of Michigan Automobile Suppliers: Initial Report. ERIC, 1986, ED284601.

⁵ Kenneth M. Nowack, "A True Training Needs Analysis." Training and Development Journal, April 1991, 69.

⁶ James Stone, Industry Based Training in Minnesota. ERIC, 1989. ED308410.

⁷ "Congress Attracts Nearly 1600 Metalcasters." Modern Casting, June 1991, 35.

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Hall 33

APPENDIX

SURVEY

Section I. Education

1. What is your job title?

2. What is your last level of education completed?

_____ 11th grade or less/12th grade or GED

_____ one/two years of college

_____ three/four years of college

_____ more than four years of college

Section II: Plant Information:

3. How many total employees are in your plant?

_____ 1 to 50

_____ 50 to 100

_____ 100 to 300

_____ 300 to 600

_____ 600 to 1200

_____ over 1200

4. Do you have a training coordinator at your facility?

_____ yes

_____ no

_____ not sure

5. How long have you been with this company?

6. How many people are there in your facility with the following classifications? Write the number in the blank provided.

___ Electricians
___ Supervisors of electricians
___ Electrical engineers
___ Electronic technicians

7. What at kind of metal do you melt in your plant? You may select more than one type.

___ Cast iron
___ Steel and steel alloys
___ Copper and brass
___ Aluminum

8. How many induction melting furnaces do you have at your plant?

___ induction melting furnaces

9. What is the size of your furnace in melt-holding capability. Please list all furnaces in tonnage or pounds.

Section III: Marketing Information

10. How often is there a new person employed in your department?

Number of Employees

Year

___ in the last year
___ two years ago
___ three years ago
___ five years ago

11. How often does your plant provide training for your electrical people?

_____ 2 sessions every six (6) months or approximately twice a year

1 session every year

_____ 1 session every 2 years

_____ 1 session more than two years apart

12. Over the last five (5) years, has your plant management provided more training?

yes

no

13. Over the last five years, have you seen a trend (need) for more training for you to do your job?

_____ yes

no

14. Do you think management understands the need for training as much you believe it is needed?

 / / / / / / / / / /

very little some alot

15. If you believe more training is needed, why do you think management does not agree? Please check as many as appropriate.

_____ Budget reasons

Time allotment

Loss of productivity

Quality training not available

Other If other, what

16. Is there a budget set aside for training only?

_____ yes
_____ no
_____ not sure

17. If you were allowed to choose the training time, when is the best time for training in your department or area? Please rank order these with #1 being the best time to #6 the least favored time.

- ___ January/February
- ___ March/April
- ___ May/June
- ___ July/August
- ___ September/October
- ___ November/December

18. How do you normally receive information about training classes? Please check as many as are appropriate.

_____ through your supervisor
 _____ through trade magazines/papers
 _____ from other co-workers
 _____ from training coordinators
 _____ from plant bulletin boards
 _____ from home mail
 _____ from professional organizations
 _____ from equipment manufacturers
 _____ Other:

19. If there is a class you wish to attend, how much do you influence the decision to go?

very little _____ some _____ alot

20. Are there any nonelectrical people needing training on electrical concepts?

_____ yes
 _____ no
 _____ not sure

21. What would you prefer in a teaching schedule? Circle your preference for each line.

MOST					LEAST	TIME of SESSION
5	4	3	2	1	8 hour session in-plant	
5	4	3	2	1	1/2 day session in-plant for "X" number of days	
5	4	3	2	1	8 hour session off-site	
5	4	3	2	1	A few hours before or after work	

22. What do you think your plant management would prefer? Circle managements's preference for each line.

MOST					LEAST	TIME OF SESSION
5	4	3	2	1	8 hour session in-plant	
5	4	3	2	1	1/2 day session in-plant for "X" number of days	
5	4	3	2	1	8 hour session off-site	
5	4	3	2	1	few hours before or after work	

23. Why do you think training is necessary at your plant? Check as many as you feel are appropriate.

___ New equipment and technology in plant
 ___ Machines have become more complicated and require more technical knowledge to repair
 ___ Need a refresher course
 ___ Our electricians do not have formal electrical training and need basic electrical concepts

24. What topics would you like to have more training in? Circle your preference for each line.

Needed			Not Needed		TOPICS
5	4	3	2	1	
5	4	3	2	1	---DC circuits series and parallel
5	4	3	2	1	---AC circuits series and parallel
5	4	3	2	1	---Power circuits (real reactive, apparent, power factor)
5	4	3	2	1	---DC generators
5	4	3	2	1	---AC generators
5	4	3	2	1	---DC motors
5	4	3	2	1	---AC motors
5	4	3	2	1	---Magnetic fields and circuits
5	4	3	2	1	---Transformers - potential and current
5	4	3	2	1	---Power SCR's
5	4	3	2	1	---Electrical amplifiers
5	4	3	2	1	---Digital electronics
5	4	3	2	1	---Microprocessor construction and programming
5	4	3	2	1	---Programmable controllers
5	4	3	2	1	---Basic ladder diagram reading
5	4	3	2	1	---Motor starter circuits
5	4	3	2	1	---Basic computer programming
5	4	3	2	1	---Induction melting - Electric principles
5	4	3	2	1	---Pneumatic circuits
5	4	3	2	1	---Hydraulic circuits
5	4	3	2	1	---National Electric Code
5	4	3	2	1	---How to operate and use an oscilloscope

25. Are there other topics you would like to have training in to help you in your present job?

26. What method is the best combination of training for you?
Circle one number of your preference for each line.

MOST					LEAST	METHOD

5	4	3	2	1		---Read material and mail-in tests
5	4	3	2	1		---Attend lectures
5	4	3	2	1		---Attend lectures with practical problems
5	4	3	2	1		---Attend short lectures with hands-on experiments with use of appropriate equipment
5	4	3	2	1		---Lecture followed by inspections of equipment at your plant

27. What new equipment do you now have which you feel you need to know more about?